



Moringa Leaf Extract Capsules Enriched with Royal Jelly on Cortisol and Stress

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Abstract

During pregnancy, physiological and psychological changes often increase stress and cortisol levels. Administering moringa leaf extract capsules fortified with royal jelly presents a viable intervention to alleviate this stress. This study investigates the specific effects of these capsules on cortisol and stress levels in pregnant women. The study was conducted as a valid experimental, single-blind, randomized controlled trial involving 61 pregnant women. The intervention group ($n=31$) received moringa leaf extract capsules enriched with royal jelly, while the control group ($n=30$) received multi-micronutrient supplements. The findings revealed a noteworthy reduction in cortisol levels within the intervention group ($p=0.030$), from 26.61 ± 8.15 to 19.98 ± 14.00 , as well as in the control group ($p=0.003$), from 21.13 ± 7.76 to 13.26 ± 16.09 . Likewise, stress levels exhibited a significant decrease within the intervention group ($p=0.016$), decreasing from 18.68 ± 3.74 to 28.75 ± 15.02 , and the control group ($p=0.000$), declining from 19.17 ± 3.64 to 16.20 ± 3.38 . Moringa leaf extract capsules enriched with royal jelly, as a natural remedy, merit the recommendation for inclusion in initiatives to enhance maternal and infant health.

Introduction

Pregnancy represents a period marked by profound psychological shifts, characterized by emotional variability and the oscillation between positive and negative affect commonly observed during this phase. These changes facilitate preparing for and adapting to parenthood, self-identity exploration, nurturing couple relationships, and fostering parent-infant bonding (Bjelica *et al.*, 2018). Hormonal fluctuations inherent to pregnancy can exert an influence on mood, precipitating sensations of anxiety, melancholy, ire, and stress. Furthermore, the advent of physical alterations,

coupled with symptoms such as nausea, fatigue, and discomfort, can further impinge upon emotional well-being (Fahami *et al.*, 2018). The American College of Obstetricians and Gynecologists (ACOG) advocates for the assessment of stress levels during each trimester of pregnancy and postpartum periods as a preventive measure against stress-related complications during gestation. This guidance stems from the recognition that stress holds the potential to significantly impact pregnancy outcomes, manifesting in phenomena such as low birth weight, preterm delivery, and neurological impairments (Gondwe &

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Chapman, 2022).

The physical and mental health of mothers and their babies are negatively impacted by poor maternal mental health. (McCarthy *et al.*, 2021). Furthermore, heightened stress levels among pregnant women can precipitate decreased engagement with antenatal and postnatal care services, insufficient nutritional support, elevated susceptibility to pre-eclampsia, heightened likelihood of encountering breastfeeding challenges, and suboptimal parenting practices (Mcnab *et al.*, 2022). A 2018 Basic Health Research study carried out in Indonesia found that moms who choose not to obtain prenatal treatment at healthcare facilities have a 2.4-fold increased risk of developing depression in comparison to those who receive the proper prenatal care. (Wurisastuti *et al.*, 2018). As a result, prenatal depression is one of the most common mental health conditions during the perinatal period and places a significant cost on public health (Hu *et al.*, 2019).

In 2022, one in five pregnant women worldwide will face poor mental health conditions both during and after pregnancy, according to the World Health Organization (WHO). Additionally, according to WHO data from 2019, mental health issues, particularly depression, affected 10% of pregnant women and 13% of new moms worldwide. Poor mental health can result from a variety of health issues faced by mothers, babies, or their families. In developing countries, these estimates are significantly higher, with rates reaching 15.6% during pregnancy and 19.8% postpartum. (WHO, 2022). Primary healthcare services in Indonesia are provided by 10,321 Community Health Centers (Pusat Kesehatan Masyarakat, or PUSKESMAS) dispersed throughout 7,230 districts. Still, these services are not fully utilized to meet the needs of the people living in 8,506 urban sub-districts and 76,941 villages. As a result, strengthening networks and partnerships with community health centers become essential, requiring capacity building and the creation of effective referral systems (Kemenkes, 2023).

As an outgrowth of community health centers, Integrated Health Service Posts (Indonesian: Pos Pelayanan Terpadu

[POSYANDU]) are essential to improving health outcomes. These include lowering morbidity and mortality rates for mothers and children, encouraging healthy lifestyles, increasing community participation and ability in health-related activities, and advocating for family planning. Pregnant women, postpartum and nursing moms, infants, toddlers, preschoolers, school-age children, adolescents, productive age groups, and elderly are among the targeted populations of integrated health service posts. However, because their primary focus is still on physical examinations, integrated health service units in Indonesia have not yet implemented mental health assessments for these cohorts. Furthermore, the competence to perform mental health assessments at this entry level is insufficient (Kemenkes, 2022).

During pregnancy, stress increases metabolism, leading to heightened nutritional demands. Adequate and nourishing dietary intake becomes imperative to address this need (Hidayati *et al.*, 2024). Government regulations mandate the provision of iron-folic acid (IFA) tablets, totaling a minimum of 90 tablets for all pregnant women throughout gestation. In specific regions, particularly those grappling with high stunting rates, the distribution of IFA is substituted with multi-micronutrient supplements, exemplified in the Banggai Regency, Central Sulawesi (Widasari *et al.*, 2020). The implementation of these multi-micronutrient supplements constitutes a targeted intervention program aimed at averting low birth weight infants resulting from premature delivery and pregnancy-induced stress (Widasari *et al.*, 2019). Nevertheless, this initiative still falls short of its optimal potential, as evidenced by data revealing low adherence rates among pregnant women in Banggai Regency, standing at a mere 51.6% (Thahir *et al.*, 2023).

In addition to supplementation, fulfilling nutritional requirements can be accomplished by consuming foods rich in micro and macronutrients. Moringa—a nutrient-dense vegetable—contains polyphenols that reduce cortisol levels (Hadju *et al.*, 2020). A study by Kumalasary (2022) illustrates that administering honey-infused moringa effectively reduces stress among pregnant women, underscoring

moringa's superiority over other vegetables. The abundant polyphenol content in moringa is advantageous in mitigating pregnancy-related stress owing to its calming properties. Furthermore, moringa contains gamma-aminobutyric acid (GABA) (Kumalasary, 2021). Non-essential amino acid GABA inhibits stress-related impulses and interacts with central nervous system receptors to support proper brain function (Roshan-Milani *et al.*, 2021). Additionally, GABA can alleviate feelings of anxiety and address emotional stress-related disorders (Bagheri *et al.*, 2020). The presence of GABA in moringa leaves can relieve stress in pregnant women, mainly due to psychological changes such as feelings of depression, anxiety, fear, discomfort, and others (Gilfarb & Leuner, 2022).

Apart from moringa, royal jelly is also a valuable dietary source offering significant benefits for the health of pregnant women. It contains many complex nutrients renowned for their antibacterial, antitumor, anti-allergic, and anti-inflammatory properties. Royal jelly functions as an immunomodulator and includes a wide range of bioactive substances, such as proteins, fatty acids, adenosine monophosphate, adenosine, acetylcholine, polyphenols, and hormones like estrogen, progesterone, testosterone, and prolactin. Under stressful circumstances, royal jelly can boost the antioxidant system and increase corticosterone levels. It was evidenced in a study by (Teixeira *et al.*, 2017), showcasing a reduction in cortisol levels among Wistar rats following royal jelly administration. This study aims to evaluate the distinct impacts of administering moringa leaf extract capsules enriched with royal jelly on alterations in cortisol levels and stress levels in pregnant women.

Methods

This study employed a valid experimental design with a single-blind randomized controlled trial. The research took place in South Batui District and Moilong District, Banggai Regency, Central Sulawesi Province. The region is an area within the Pertamina-Medco Tomori Joint Operating Body company area. This research took time from July to October 2023. The study population comprised all pregnant

women, and sample selection was based on specific inclusion criteria: pregnant women in the first and second trimesters. The exclusion criteria are pregnant women who do not have chronic diseases. The dropout criteria were not taking the capsules for more than 7 consecutive days, experiencing severe side effects from the intervention, and moving to a location unreachable by health workers. Cortisol levels and stress levels are measured through pre and post-assessments to determine the difference between the two. Measurements were carried out by taking a specimen of the mother's saliva in the morning (between 8 – 9 am) for cortisol level analysis, and they were asked to complete the Depression Anxiety Stress Scales (DASS 42) questionnaire to evaluate their stress levels. At the beginning of the study, the initial sample size comprised 66 pregnant women who were randomly allocated into two groups: the intervention group, consisting of 33 pregnant women receiving moringa leaf extract capsules enriched with royal jelly (2×500 mg), and the control group, consisting of 33 pregnant women receiving multi-micronutrient supplements (1×500 mg). However, by the end of the study, the sample size had decreased to 61 pregnant women, with 31 in the group receiving moringa leaf extract capsules enriched with royal jelly and 30 in the group receiving multi-micronutrient supplements. This reduction was attributed to factors such as miscarriage, relocation, use of other medications prescribed by doctors, and irregular medication intake.

The instruments used in this study consisted of an interview guide, explanation sheet for respondents, consent form, screening questionnaire, observation sheet for the implementation of the intervention, Depression Anxiety Stress Scales (DASS 42) questionnaire to measure stress levels, and salivary cortisol ELISA kit to measure cortisol levels. Univariate analysis was employed to determine the distribution of research subjects and calculate frequencies and percentages of each variable using the chi-squared test. Bivariate analysis in this study involved statistical tests like the independent *t*-test, Mann-Whitney test, and Wilcoxon test. All statistical analyses were performed using SPSS version 25. Ethical Considerations in this study were conducted

by the research ethics approval filed (Ethical Clearance) to the Research Ethics Committee of the Faculty of Public Health, Hasanuddin University Number 4352/UN4.14.1/TP.01.02/2023. Mothers prove this willingness to participate in research activities by signing informed consent forms after receiving explanations. Explanations of mothers in the study included the confidentiality of research results.

Results and Discussion

Table 1 presents the characteristics of participants across all groups. The average age fell within the low-risk category (20 – 35 years), with 100% in the intervention group (receiving moringa leaf extract capsules enriched with royal jelly) and 83.3% in the control group (receiving multi-micronutrient supplements). Most participants were multigravida, constituting 77.4% in the intervention group and 70% in the control group. The most common pregnancy interval fell under the low-risk category (≥ 2 years) in both the intervention group (83.9%) and the control group (93.3%). Regarding nutritional intake, the majority were still deficient, with 80.6% in the intervention

group and 53.3% in the control group. Most participants had a high level of education, with 71.0% in the intervention group and 53.3% in the control group. However, the majority were unemployed, comprising 87.1% in the intervention group and 83.3% in the control group. Regarding income, the majority still had low income, with 74.2% in the intervention group and 63.3% in the control group.

Based on the findings from Table 2, it is evident that the average cortisol levels in both the MRJ and MMS groups showed a notable decrease after the intervention. Specifically, the Wilcoxon test revealed a statistically significant p -value of 0.030 for the MRJ group, indicating a significant reduction in cortisol levels post-intervention. Similarly, the paired sample t -test conducted for the MMS group demonstrated an even lower p -value of 0.000, underscoring a highly significant decrease in cortisol levels following the intervention. Given that both p -values are less than 0.05, these results collectively highlight a substantial and statistically significant decline in cortisol levels within both groups from pre- to post-intervention stages.

Based on the data presented in Table 3, it

Table 1. Distribution of Respondents' Characteristics

Characteristics	Categories	Groups			
		MRJ		MMS	
		n	%	n	%
Age	Low risk	31	100	25	83.3
	High risk	0	0	5	16.7
Parity	Primigravida	7	22.6	9	30
	Multigravida	24	77.4	21	70
Pregnancy Interval	Low risk	26	83.9	28	93.3
	High risk	5	16.1	2	6.7
Nutritional Intake	Adequate	6	19.4	14	46.7
	Inadequate	25	80.6	16	53.3
Education	Low	9	29.0	14	46.7
	High	22	71.0	16	53.3
Occupation	Unemployed	27	87.1	25	83.3
	Employed	4	12.9	5	16.7
Income	Low	23	74.2	19	63.3
	High	8	25.8	11	36.7

Source: Primary Data, 2024

Table 2. Differences in Cortisol Level Changes Before and After Intervention in The Group Receiving Moringa Leaf Extract Capsules Enriched With Royal Jelly (MRJ) and The Group Receiving Multi-Micronutrient Supplements (MMS)

Variables	Pre	Post	<i>p</i> -value
	(mean ± SD)	(mean ± SD)	
MRJ	26.61 ± 8.15	19.98 ± 14.00	0.030*
MMS	21.26 ± 7.86	10.97 ± 10.33	0.000**

Note: *Wilcoxon, **Paired Sample Test

Table 3. Stress Level Changes Before and After Intervention in The Group Receiving Moringa Leaf Extract Capsules Enriched With Royal Jelly (MRJ) and The Group Receiving Multi-Micronutrient Supplements (MMS)

Variables	Pre	Post	<i>p</i> -value
	(mean ± SD)	(mean ± SD)	
MRJ	18.68 ± 3.74	15.90 ± 5.60	0.016*
MMS	19.17 ± 3.64	16.20 ± 3.37	0.000*

Note: *Wilcoxon Test

Table 4 Differences in Cortisol Level and Stress Level Changes in The Group Receiving Moringa Leaf Extract Capsules Enriched With Royal Jelly (MRJ) and The Group Receiving Multi-Micronutrient Supplements (MMS)

Variables	MRJ	MMS	<i>p</i> -value
	(mean ± SD)	(mean ± SD)	
Cortisol level	(-6.63) ± 15.04	(-10.27) ± 13.09	0.321*
Stress level	(-2.77) ± 6.00	(-2.97) ± 2.59	0.653**

Note: *Independent Sample Test, **Mann Whitney

is observed that the average stress levels in both the MRJ and MMS groups exhibited a notable decrease following the intervention. Specifically, the Wilcoxon test yielded a statistically significant *p*-value of 0.016 for the MRJ group, indicating a significant reduction in stress levels after the intervention. Similarly, for the MMS group, the Wilcoxon test resulted in a highly significant *p*-value of 0.000, underscoring a substantial decrease in stress levels post-intervention. With *p*-values below 0.05, these results highlight a robust and statistically significant decline in stress levels within both groups from pre- to post-intervention phases.

Based on the data presented in Table 4, there are distinct observations regarding the changes between the MRJ and MMS groups. The MRJ group exhibited an average reduction

in cortisol levels of -6.63 (SD = 15.04), whereas the MMS group showed a slightly higher reduction of -10.27 (SD = 13.09). Regarding stress levels, the MRJ group had an average reduction of -2.77 (SD = 6.00), compared to -2.97 (SD = 2.59) in the MMS group. Statistical analyses comparing the changes in cortisol levels between the MRJ and MMS groups yielded a *p*-value of 0.321. Similarly, for changes in stress levels, the calculated *p*-value was 0.653. These findings indicate no statistically significant difference in the changes observed in cortisol levels and stress levels between the MRJ and MMS groups following the intervention. These results suggest comparable effectiveness of the interventions in both groups in terms of cortisol and stress reduction.

Based on the research findings, the

analysis of cortisol level changes among participants before the intervention indicated distinct patterns between the MRJ and MMS groups. Initially, significantly most participants in the MRJ group exhibited abnormal cortisol levels, which subsequently normalized following the intervention. This normalization suggests that the MRJ intervention effectively regulated cortisol levels among initially stressed participants. In contrast, the MMS group showed a different trend, where several participants already had normal cortisol levels before the intervention. Despite this, some participants maintained normal cortisol levels throughout the study period. It indicates that the MMS intervention contributed to maintaining stable cortisol levels among participants without initially experiencing abnormal stress. Statistical analysis using the Wilcoxon test demonstrated a significant decrease in cortisol levels after intervention in the MRJ group ($p = 0.030$). Similarly, the paired sample t -test for the MMS group indicated a relevant reduction in cortisol levels before and after intervention ($p = 0.000$). Moreover, the data comparison indicated no significant difference in the extent of cortisol level reduction between the MRJ and MMS groups ($p = 0.321$). It suggests that both MRJ and MMS interventions exert a comparable effect in reducing cortisol levels, underscoring their equivalent efficacy in this regard.

This study corroborates Florensia's findings (2020), demonstrating that the combination of *Moringa oleifera* and royal jelly supplements significantly reduces cortisol levels (Florensia *et al.*, 2020). Hasni & Evie (2022) highlighted moringa's nutritional superiority over other vegetables, attributing its high content of calming polyphenols as beneficial for managing pregnancy-related stress. Furthermore, moringa contains GABA—a non-essential amino acid crucial for maintaining normal brain function by modulating stress-related impulses within the central nervous system (Hasni & Evie, 2022). Research by Hadju *et al.* (2020) indicated that moringa leaf extracts and powders, akin to honey, can enhance maternal weight, hemoglobin levels, and birth weight. Moreover, both interventions are effective in reducing stress and shielding

mothers and infants from the adverse effects of oxidative stress (Hadju *et al.*, 2020).

Stress levels in pregnant women decrease, leading to a reduction in cortisol levels. High cortisol levels are closely associated with stress, and vice versa. Cortisol plays a crucial role in stress adaptation. Any type of stress significantly stimulates increased cortisol secretion, mediated by the central nervous system through the activation of the CRH-ACTH-cortisol axis. The magnitude of cortisol concentration typically corresponds to the intensity of the stressor, with greater cortisol secretion occurring in response to severe stress compared to mild stress (Russell & Lightman, 2019). This finding aligns with the study by Handayani *et al.* (2018), which examined 50 second-trimester pregnant women and identified a significant correlation between stress levels and increased cortisol hormone levels. Women experiencing stress are at a higher risk of elevated cortisol levels compared to those who are not stressed.

In Suhartatik's study (2019), moringa leaf powder was found to provide benefits similar to iron (Fe) in reducing cortisol levels during pregnancy, although these effects were not significant during breastfeeding. In contrast, Hijrawati's research (2021) revealed no significant difference in cortisol levels between the group receiving moringa extract and iron tablets and one receiving only iron tablets among preconception women. Pregnant women require balanced nutrition to meet their physiological needs. Regardless of whether their nutritional requirements are fully met, they are often provided with iron or other supplements. One such supplement is moringa leaf extract, which is rich in polyphenols and can help reduce stress and suppress cortisol production.

Cortisol plays a crucial role in the normal development of the fetus (Castro-Quintas *et al.*, 2024). During pregnancy, maternal cortisol levels increase two- to fourfold (Shriyan *et al.*, 2023). This elevation positively impacts neural development. However, excessive fetal exposure to maternal cortisol can lead to brain development disorders due to neurotoxicity. Elevated cortisol levels reach the fetus and alter the activity of the fetal HPA axis. These modifications negatively affect growth and

development through a series of complex endocrine mechanisms.

Based on the research findings, the stress levels before the intervention indicated that most respondents in the MRJ and MMS groups experienced mild stress. Following the intervention, most respondents in both groups reported normal stress levels. Initially, there were two respondents with severe stress—one in the MRJ group and one in the MMS group. After the intervention, only one respondent in the MRJ group continued to experience severe stress. This respondent was a first-time pregnant woman with a low income whose husband resided and worked outside the district. First-time pregnant women often lack experience, leading to feelings of unpreparedness and low confidence in coping with the changes during pregnancy. Additionally, low income exacerbates anxiety about meeting the needs during pregnancy, childbirth, and postpartum. Furthermore, being separated from her husband contributed to feelings of loneliness and increased sensitivity.

After the intervention, both groups experienced lower stress levels, with the MRJ group showing a p -value of 0.016 and the MMS group showing a p -value of 0.000. It indicates a significant change in each group. The data comparison revealed no significant difference in the magnitude of change between the MRJ and MMS groups, with a p -value of 0.653, suggesting that both interventions were equally effective in reducing stress levels. These findings demonstrate that MRJ can help reduce stress in pregnant women. Moringa leaves are rich in polyphenols and GABA (gamma-aminobutyric acid), a non-essential amino acid supporting normal brain function by inhibiting stress-related signals and interacting with receptors in the central nervous system. Additionally, GABA can reduce feelings of anxiety and help manage conditions related to emotional stress. The GABA in moringa leaves can alleviate stress in pregnant women, who often experience psychological changes such as feelings of pressure, anxiety, fear, and discomfort during pregnancy.

This study corroborates Rida Hafid's research (2023), which indicated a significant reduction in stress levels among pregnant

women receiving moringa leaf extract capsules. Moringa leaves are rich in essential nutrients crucial for preventing various diseases. They also provide essential amino acids, including arginine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine. Furthermore, moringa leaves contain a wealth of nutrients such as protein, fats, beta-carotene (A), thiamine (B1), riboflavin (B2), niacin (B3), vitamin C, calcium, calories, carbohydrates, copper, fiber, iron, magnesium, and phosphorus. They are also known for their high levels of polyphenols and GABA, making them an exceptional and superior nutritional source than other vegetables (Hafid & Aulia, 2023). Polyphenols are recognized for their antioxidant, anti-inflammatory, and neuroprotective properties, contributing to stress reduction and mood enhancement. GABA is implicated in reducing stress both during pregnancy and postpartum. Pregnancy entails psychological changes, including feelings of depression, anxiety, fear, and discomfort. These changes may stem from alterations in GABAergic function, given that GABA serves as the principal inhibitory neurotransmitter in the brain and regulates responses to anxiety and stress. Numerous studies have suggested that GABA supplementation can effectively alleviate stress and anxiety (Kabra *et al.*, 2022).

Stress represents a complex state influenced by an individual's physiological response to environmental changes (Pais & Pai, 2018). The foundational concept of stress response centers on homeostasis, which involves self-regulation to uphold stability in crucial bodily systems for each person. According to Cohen *et al.*, stress occurs when environmental demands surpass an individual's adaptive capacity, resulting in psychological and biological changes, heighten susceptibility to illness (Traylor *et al.*, 2020). Pregnancy represents a transitional phase marked by significant emotional changes and increased pressures. During this period, various factors come into play, including maternal psychological stressors. These stressors can have adverse effects on both fetal and neonatal development and can also impact the physical health of the mother. Furthermore,

maternal psychosocial stress has been linked to increased inflammation and disturbances in the hypothalamic-pituitary-adrenal (HPA) axis. These physiological disruptions can have significant implications for fetal neural development. Research suggests that maternal stress during pregnancy may contribute to the onset or exacerbation of neural developmental disorders through these mechanisms (Kabale, 2023).

Mild stress refers to stress that does not disturb an individual's physiological functions. It is a common experience for everyone, manifesting in forgetfulness, oversleeping, criticism, and traffic congestion. Mild stress frequently arises in daily life and serves to maintain individual vigilance. Moderate stress persists longer, typically spanning from several hours to several days. Its effects include disruptions in gastrointestinal function, such as gastritis and irregular bowel movements, muscle tension, disturbed sleep patterns, menstrual cycle irregularities, decreased concentration, and memory impairment. Examples of stressors leading to moderate stress include unresolved agreements, excessive workloads, anticipation of new job responsibilities, and prolonged absence of family members. Severe stress, on the other hand, represents chronic stress lasting from several weeks to years. Severe stress responses can have profound effects on the body. They can impact digestion, causing disruptions and discomfort. The heart rate may increase, and individuals may experience shortness of breath. Tremors and heightened feelings of anxiety and fear can also occur. In addition, severe stress can lead to confusion and panic, further exacerbating the overall psychological and physiological toll. Examples of stressors contributing to severe stress include discordant marital relationships, financial hardships, and prolonged physical illnesses.

Recent research conducted by Kumalasary (2021) suggests that administering moringa + honey (MH) to pregnant women may reduce stress and lower cortisol levels more effectively compared to regular honey (RH). This intervention resulted in a notable decrease in stress among pregnant women in the moringa honey group. According to Kusnadi (2015), moringa leaf powder contains a variety of

essential nutrients and compounds, including GABA (which is 100 times more abundant than in brown rice) and polyphenols (known for their calming properties that contribute to stress reduction during pregnancy). Furthermore, capsules of moringa leaf extract enriched with royal jelly have been shown to alleviate stress, attributed to the antioxidants found in moringa leaf extract, which are beneficial in mitigating pregnancy-related stress (Ummah *et al.*, 2023). These antioxidants—encompassing flavonoids, phenolic acids, and other phytochemicals—enhance the antioxidant capacity of moringa leaves, thereby lowering stress levels and promoting overall maternal and fetal health, as supported by the findings of this study (Zarenejad *et al.*, 2020; Hamed *et al.*, 2022).

Conclusion

Significant differences in cortisol and stress level variations exist between the group receiving moringa leaf extract capsules enriched with royal jelly and the group receiving multi-micronutrient supplements after the intervention. However, the magnitude of change between the groups is not different. It can be inferred that moringa leaf extract capsules enriched with royal jelly and multi-micronutrient supplements yield nearly identical results in this study. For governmental agencies, it is expected that efforts will be carried out to conduct routine screening for pregnant women to detect mental health issues during pregnancy and postpartum. Interventions for pregnant women experiencing stress or aimed at preventing stress could involve recommending natural products such as moringa leaf extract capsules enriched with royal jelly, thus supporting programs to enhance maternal and infant health.

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